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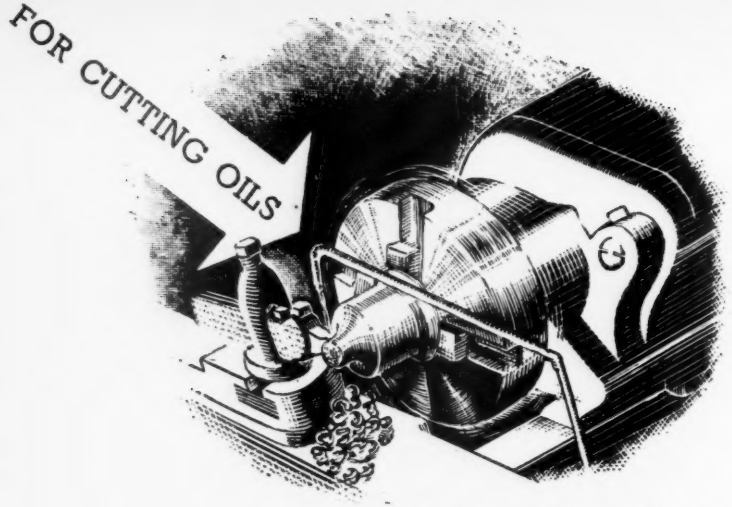

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ANGLO-AMERICAN CO-OPERATION IN STANDARDIZATION

"WE in A.S.T.M. Committee D-2 greatly appreciate the work which the Institute of Petroleum is doing in the field of standardization and we refer more and more to that work in arriving at our own standards. We have adopted quite a number of the I.P. methods and the work which we are here to discuss is of prime importance." It was in these terms that Lee C. Burroughs, Chairman of Sub-Committee XV (Measurement and Sampling) of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, acknowledged the toast of "The A.S.T.M., coupled with the names of L. C. Burroughs and J. G. Detwiler" at a luncheon recently held in London by members of the I.P. Standardization Committee to welcome the A.S.T.M. delegates who were in England to discuss oil measurement and sampling.

Mr E. A. Evans, President-Designate of the Institute and chairman of the Standardization Committee, presided at the luncheon and, in welcoming Messrs. Burroughs and Detwiler, said that the Institute of Petroleum was proud of its American friends and was grateful for what they had to offer to add to our knowledge.

Referring to Mr H. Hyams, the chairman of the Standardization Sub-Committee on Measurement Sampling, he said that the Council had a great respect for his work both on the Council and on the Standardization Committee. They were particularly proud of their two publications on oil measurement

Lee C. Burroughs

which had only been made possible by the efforts of Mr Hyams.

Mr Hyams, proposing the toast of "The A.S.T.M.", referred briefly to the history and development of that body since 1882 and congratulated it on gaining two well - deserved distinctions during the last war for its work in the realm of material testing and inspection. These were the U.S. Army Ordnance Distinguished Service Award (1944) and the U.S. Navy's Certificate of Achievement (1946).

Turning to the particular sphere of oil measurement and sampling, Mr Hyams congratulated Mr Burroughs on the promotion of his sub-committee to the status of a research division, an indication of the importance which the A.S.T.M. attached to oil measurement procedures.

He was sure that their talks during the next few weeks would yield fruitful results and was confident that the beneficial results of co-operative endeavour in the field of standardization would be demonstrated. He was sure that, continuing in the spirit in which those on both sides of the Atlantic had worked on oil measurement standardization during the last 15 years, joint A.S.T.M.–I.P. publications would emerge and go very far towards international accord.

Coupling the names of Lee C. Burroughs and J. G. Detwiler with the toast, he asked them to take back to the A.S.T.M. the warm greetings of the I.P. and expressed the hope that a two-way traffic in the harmonious exchange of views and subsequent action in matters of mutual interest would now develop and continue at an ever increasing rate.

James G. Detwiler

Dr A. E. Dunstan, supporting the toast, referred to his early contacts with the A.S.T.M. and how festive gatherings after serious discussion had done much to cement remarkably tenacious friendships between individuals and organizations.

Also supporting the toast, Col. S. J. M. Auld, past-president of the Institute, said that international relationships based on what could be got out of them were false. They should be based on sentimentalism. During the last twenty-five years Britain and America had attained an association that could not have been reached otherwise. The petroleum industry had a great responsibility, and a great opportunity of making personal friends.

The toast was accorded applause and, after Mr Burroughs had replied as above, Mr J. G. Detwiler also responded briefly.

INTERNATIONAL RHEOLOGICAL CONGRESS

Full details regarding this Congress are now available from the Secretary of the Congress, Julianalaan 134 (Postbox 66), Delft, Holland. The Congress is to be held at the Kurhaus Hotel, Scheveningen, from September 21 to 24 inclusive and registration fee is Fl.15, which includes the cost of preprints.

It is regretted that space limitations necessitate Mr J. A. Oriel's address on "Petroleum in the Modern World" being held over until next month.

THE DEVELOPMENT AND SIGNIFICANCE OF ANGLO-AMERICAN CO-OPERATION IN THE FIELD OF OIL MEASUREMENT STANDARDIZATION*

By H. HYAMS† (*Vice-President*)

INTRODUCTION

THE presence of Mr L. C. Burroughs, the Chairman of Sub-Committee XV (Measurement and Sampling) of the A.S.T.M. Committee D-2, and Mr J. G. Detwiler, a prominent member of that Sub-Committee, at our meeting to-day justified, I thought, a review of the development of the co-operative work on oil measurement and sampling which has been actively pursued by the A.S.T.M. and the I.P. during the last 16 years. It seems to me that only by such a review can we decide whether we are following the correct paths, whether the results are up to expectations and what we can hope finally to achieve. I hope that when I have concluded my brief summary of the position I shall not only be privileged to hear the objective views of my colleagues on this I.P. Sub-Committee but that my good friends Burroughs and Detwiler will join with their opinions on the best means of accomplishing maximum results in oil measurement standardization through our continued joint efforts.

HISTORICAL

The A.S.T.M. had a Sampling and Gaging Committee long before I.P. set up its corresponding committee. So far as I am aware, beyond responsibility for the standard method of sampling petroleum and its products in the annual volume of test methods published by A.S.T.M. Committee D-2, Sub-Committee XV through its Gaging Group had never produced standardized procedures for the measurement of bulk petroleum products. I believe I am correct in saying that such work was,

* Inaugural Meeting of Standardization Sub-Committee No. 1 (Measurement and Sampling), April 22, 1948, and attended by the A.S.T.M. delegates, L. C. Burroughs and J. G. Detwiler.

† Chairman, Standardization Sub-Committee No. 1.

Anglo-American co-operation in effect. The Panel on Units of Measurement, Calculations and Tables in session with the A.S.T.M. delegates to left and right of the Chairman (H. R. Holmes).

until the middle thirties, left largely in the hands of bodies such as the A.P.I.

It was in 1932 that Mr James Kewley, then President of the Institute, suggested the setting up of a section of the Standardization Committee to cover the subject of oil measurement and in particular the preparation of an authoritative publication on the subject of the various national fundamental units generally used in the oil industry. Evidence had been brought to Mr Kewley's attention which proved inconsistencies in procedures, and the use of antiquated data and equipment in the oil industry for the measurement of products, bought and sold. The particular example which led him to propose that the new committee should investigate without delay the weights and measures used in computing quantities was the incorrect factor which at that time was being widely used for the conversion of cubic feet into English gallons in tank calibration work.

I.P. Sub-Committee No. 10, as it was then called, published in 1932 the first section of its work under the title "Measurement of Oil in Bulk—Part I —Weights and Measures". There can be no denying that this publication helped to clear away many misinterpretations and inconsistencies which had been prevalent in the industry. It accordingly won wide acceptance and a few years later, after contacts had been made with the A.S.T.M., the A.P.I. and the American oil industry adopted the tables of conversion factors which the I.P. had recommended.

DEVELOPMENT OF A.S.T.M./I.P. CO-OPERATION

It was Mr Kewley also, in his capacity of first Chairman of the Institute's Measurement and Sampling Committee, who in the early 1930's initiated the co-operative work with the A.S.T.M. by his contacts with Dr Flowers, the then Chairman of the A.S.T.M. Sub-Committee XV. There is no doubt that the early investigational work by our committee and the wide experience which people like Mr Peter Kerr were able to place at the disposal of the technical committees, assisted in the sureness of the foundation of this co-operative work, the fruits of which we are witnessing to-day. It is no secret that the booklet entitled "Oil Measurement" which appeared in 1939 under Mr Kerr's name won golden opinions on the other side of the Atlantic and helped materially in assessing the contribution which we on this side had to make on the subject.

Co-operative work developed slowly in the pre-war years but contacts and regular exchanges of views between our two organizations were gradually being expanded. The rapid development rather than the postponement of our activities during the war years is a compliment to both our societies for the tenacity with which we held to the worth-while nature of the work on which we were engaged. Everyone of our members was in some form or other fully occupied on war work. But somehow or other we maintained our contacts in Britain and if meetings were only rarely possible we dealt with our business in our spare time (frequently during air raids) and whenever we saw each other on other business. And all the time, I, who had succeeded Mr Kewley in 1940 as Chairman of the I.P. Committee, bombarded Mr Burroughs (who had been appointed Chairman of his Committee) with cannon shells of paper, preparing the ground for when we could work under more peaceful conditions. It was indeed in 1943 and 1944 that we completely remodelled the work of our Sub-Committee, divided our studies between a series of panels and set about the production of a comprehensive work on oil measurement standardization. We were glad to have your Committee, Mr Burroughs, follow similar lines, so that to-day we can say that both in our

concept of the work in hand and in the planning thereof we are at one.

PRINCIPLES GOVERNING OIL MEASUREMENT PROCEDURE

It was in early 1944 that we in our Committee first drafted and then finalized a document on "Principles" on which we felt we desired to have the agreement of our friends in the A.S.T.M. We were indeed gratified when our American friends, after proposing some minor amendments which we were glad to accept, intimated that they were prepared to have these "Principles" published with their blessing. Accordingly, the identical document on "Principles" was published in 1945 in I.P. "Standard Methods for Testing Petroleum and Its Products" and in the A.S.T.M. "Standards on Petroleum Products and Lubricants".

The contents of this agreed basic paper on principles are of such fundamental importance that it would be as well to review to-day what we both pledged ourselves to do in 1945 and to see whether we are following the correct paths. I quote firstly from the preamble to "Principles".

"*The Institute of Petroleum Sub-Committee No. 1. 'Measurement and Sampling of Oil' and the American Society for Testing Materials Committee D-2, Sub-Committee XV 'Sampling and Gaging' have undertaken co-operative work to establish oil measurement procedures and standards which would be acceptable in both the British Empire and the United States. Such codes would eliminate major differences in oil measurement methods as practised in England and the United States, thereby aiding in the establishment of world-wide uniformity of measurement procedure. The following 'Principles' have been agreed upon by the two Committees to serve as a guide to govern their individual detailed work.*"

DISCUSSION ON "PRINCIPLES"

In this paper on "Principles" we have committed ourselves in the following terms as to what shall be regarded as a correct quantity of oil. We say:

A "quantity figure will be substantially correct if

(a) *The accepted oil temperature*

(b) *The accepted oil gravity*

are fair averages for the container's contents. This implies

(c) *The container must be adequately sampled.*

Further—the accepted oil volume must be substantially correct. This implies:

(d) *The measured oil depth (dip or ullage), and*

(e) *The capacity tables for the container are both substantially correct.*

Finally:

(f) *All calculations, including any corrections applied, must be substantially correct also.*"

Then later in the document under the headings of Methods and Precision, we say:

"**Methods**.—*Preference shall be given to measurement of volume at 60 F and data should preferably be reduced along the lines of U.S. National Bureau of Standards Circular C410 or the forthcoming I.P. publication 'Tables for Measurement of Oil'.*

"**Precision**.—*The attitude of the I.P. and A.S.T.M. Committees is that no simple precaution which tends to improve accuracy should be omitted, but that this must not involve the present relatively simple instruments (dip tape, thermometer, hydrometer and so on) being replaced by others more complex, nor should precautions with present instruments be carried so far that procedures become cumbrous. The construction and standardization of all oil measurement equipment should, however, be carefully specified*".

My re-reading of "Principles" leads me to the conclusion that we have both of us kept to its narrow paths and I suggest to good purpose. But I think we might well take stock of the position to-day and discuss whether we should vary any of our earlier decisions.

RESULTS ACCOMPLISHED BY CO-OPERATIVE WORK

All of us are made fully aware of the closeness of our collaboration by reason of the volume of paper with which we are bombarded, and here I must extend my sincere congratulations to Mr Burroughs on the speed with which his various sections are producing results. When one takes into account the wide areas over which his members are scattered and the need for exchange of views by post one realizes how keen are our American colleagues and how effective their machine under Mr Burroughs' able guidance.

We are having to give close study to the drafts prepared by the sections covering every single aspect of oil measurement. We ourselves have already published a book of tables, a standardized procedure for measurement of oil depths, and a tentative standard method for calibrating vertical storage tanks. But in the meantime our American friends are rapidly reaching the final draft stages for a variety of standard oil measurement procedures.

We are happy in the knowledge that the fullest opportunity is given for study and comment of all drafts by the corresponding committee on the other side of the Atlantic and I am sure that due note is taken of the views expressed. There is no need in my view for American and British standardized oil measurement procedures to be identically phrased or couched in the same terms. Conditions in Britain and in British territories differ in many ways from those in the U.S.A. so that differences in units and equipment and to a lesser extent in procedures there must be. But we must at all times attempt to iron out these differences so as to get the closest possible agreement in the standard methods which are issued under the imprint of our respective institutions.

The likely extension of this co-operative work is seen in the primary object of the visit to Britain of our two guests —the production of oil measurement tables in the joint names of the two institutions. As we are going to cater for people outside the orbit of the United States and the British Commonwealth, namely those countries on the metric system, there is here ample evidence of the possible application of our joint efforts in the international field. I hope that it will be agreed that the wide interests of our two countries in petroleum justifies our placing our knowledge and experience in these matters of oil measurement at the disposal of those who desire to benefit from what we have, in all good faith, to offer.

SIGNIFICANCE—WHAT DO WE REALLY ACHIEVE BY UNIVERSAL STANDARDIZATION

It is as well for us to consider what is the real significance and the objective of these our efforts in the field of oil measurement standardization. Much thought, time and energy is being devoted to this work. Is it yielding results which have a real and practical significance? I think we can truthfully say that the value of our work is being and will continue to be reflected in two important directions:

First *we are slowly but surely eliminating the sources of disputes both in our national domestic transactions as between buyer and seller and in international commerce when cargo quantities of petroleum products are shipped from one part of the world to another. When testing petroleum products for quality, unless the two parties to a contract or*

sale use identical procedures and apparatus for assessing the quality, disputes arise regarding compliance with specification. Similarly, we may be involved in disputes over quantities if agreed and recognized measurement methods and equipment are not used by both sides. It is therefore of the utmost importance that our studies be translated into standard methods as quickly as possible and that the recognized channels be then used for having such methods and procedures established on a universal basis. If, for example, China measures the oil she buys in the metric system the method which she uses in computing her receipts should yield almost identical results with those obtained in say, U.S.A. or Singapore in calculating the quantity shipped by American or British methods. That involves a knowledge in China of the standard methods used in U.S.A. and Singapore for calibrating tanks, measuring the average temperature of a container, correcting volume to a standard temperature, etc. For all these reasons, therefore, the results of our Anglo-Saxon co-operative work must be made wider and wider available.

And **Secondly** *standardized and well-conceived oil measurement practice will necessarily give us a higher standard of accuracy. The best possible accuracy, within practical limits, is of considerable importance and for two reasons:*

(a) *An oil company is entitled to receive correct measure on all purchases. It also desires neither to over deliver nor under deliver in its sales.*

(b) *Unless oil is measured accurately there is no reliable means of securing adequate control over storage, transport and distribution losses. These losses are equivalent to cash so that it is necessary to reduce them to a minimum. It is only by balancing the cash value of real losses against the cost of the installation of improved equipment which is known to reduce losses, that one can calculate whether the capital cost involved can be justified. And unless we can measure our oil with a reasonably high degree of accuracy we cannot say what are the real physical losses involved.*

In this brief survey I have attempted to sketch the history of our co-operative work during the past 16 years and have tried to demonstrate that in the interests of our industry it is our duty to spread the beneficial results of our standardizing activities over the wider international field. We have no difficulty in convincing ourselves and others of the practical results we have achieved. But we realize that much still remains to be done and that many years of work still lie ahead for us. We are rightly proud of this Anglo-American co-operation—long may it flourish in that same spirit of goodwill and pleasant understanding that has existed in the past.

PERSONAL NOTES

F. A. Trim, F.Inst.Pet., has been appointed London representative of Universal Oil Products Company in succession to *W. A. Keightley*, F.Inst.Pet., who has returned to Chicago as a member of the Commercial Development Department. Mr Trim joined Universal in 1934, and has since served as assistant to Dr Victor Henny, former U.O.P. London representative, and later to Mr Keightley.

J. L. Murray, M.Inst.Pet., was selected to play for Wales in the recent International Bridge Match.

H. E. F. Pracy, F.Inst.Pet., has been appointed Joint General Manager of "Shell's" new refinery scheme at Heysham. For the last four years he has been General Manager of the Stanlow refinery, and has been Chairman of the Institute's Stanlow Branch since 1946.

Launcelot Owen, F.Inst.Pet., is due to arrive in England on June 9 on leave from Australia.

COUNCIL COMMENTARY

AT a fairly well-attended last of the session meeting of Council on April 14, there was no sign of "end of season fatigue", which is just as well, seeing that substantially the same Council is entrusted with the conduct of Institute affairs in the hectic times ahead. After the Minutes of the previous meeting had been approved and signed, several matters arising from them were dealt with before passing on to fresh matters, such as Committee reports. The Election Committee brought forward again the thorny question of members in arrears with subscriptions and was empowered to bring matters to finality within a reasonable time. The very real difficulties of certain members due to war activities and loss of contact rather than loss of interest are fully realized, but no healthy tree can safely carry indefinitely dead wood. Let any moribund wood liable to be regarded as dead be advised that pruning is in prospect.

There is a gratifying increase in the number of applicants and it is to be hoped that many more will come forward. Every member of the industry should seek to find his place in the Institute, which now has many mansions and few closed doors.

Publications Committee had to report a very rare occurrence in that the paper scheduled for May 12 would not be available. It was decided to fill the evening with films and film talk.

Standardization Committee, through its Chairman, Mr E. A. Evans, presented report ST.88 and again raised the question of membership of committees *vis-a-vis* membership of the Institute. It was again confirmed—this continually crops up—that as an ideal, membership, and particularly chairmanship, of such committees should be confined to members of the Institute, but at present this rule might still act very beneficially through its limited exceptions. Distribution of copies of "Standard Methods" was discussed and a report on present practice called for from the Publications Secretary.

A signed request for the formation of a London Branch was received and tabled, savouring a little of giving permission to a healthy young child to get itself born! The list of officials of branches to serve as ex-officio members of Council was accepted from Branches Committee to be put forward for approval at the Annual General Meeting. Several formalities in connexion with the Annual General Meeting were discussed and decisions taken.

The sending of formal congratulations to Dr G. M. Lees on his election as a Fellow of the Royal Society was approved.

Professor Garner explained that the Codes of Practice Committee of the Ministry of Works had requested the Institute of Petroleum to submit proposals, and tabled the recommendations of the Chairman's Co-ordinating Committee of the Liquid Fuels Installation Committee. These were approved and the Chairman's Co-ordinating Committee was empowered to act for the Council of the Institute. It was suggested that the Code Committee should consider the inclusion of a representative from the Institute of Fire Engineers, which Professor Garner promised to put forward.

It was agreed that the Aviation Products Data Committee, who submitted their fourth report, should have permission to submit data direct to the joint Committee of the Royal Aeronautical Society and the Institute of Petroleum without first consulting Council.

Professor Garner's resignation as Chairman of the Aviation Products Data Committee was accepted with

regret and he was warmly thanked for his services. The nomination of Mr Garton as Chairman was approved. It was agreed that Messrs Garton and Hyams should attend, if possible, a special meeting of the British Standards Institute Petroleum Industry Standards Committee, at which two visiting delegates from A.S.T.M. would be present.

The Chairman of the Council reported conversations with Mr Kaplin, who expressed the wish of the Association Française des Techniciens du Pétrole to resume collaboration with the Institute of Petroleum, and who would like a paper, preferably in French, at a forthcoming conference in Paris fixed for October. Mr E. J. Dunstan was to be asked to consider this.

Mr E. Thornton, Chairman of the Education Committee, asked for early consideration of the attitude of the Institute of Petroleum to the new City and Guilds of London examination as a qualification for Associate Fellowship. The Education and Election Committees were asked to discuss this question jointly and to report to Council.

The House Committee Minutes were presented by the Hon. Secretary and approved, it being said that a draft lease was now in the hands of the Institute's solicitors.

Altogether, a busy meeting, well conducted by the retiring Chairman, who will receive more formal thanks at the next meeting, but who was congratulated by the incoming President-Designate at this meeting.

SOUTH WALES BRANCH

THE Annual General Meeting of the South Wales Branch of the Institute of Petroleum was held at Llandarcy on February 6, 1948.

The Chairman, Mr R. B. Southall, in his opening remarks commented on the fact that this was the first General Meeting to which non-Corporate Members had been eligible to attend and, in inviting them, the Committee were anticipating the new Branch Rules which were to be put before the Meeting. The Chairman also mentioned the gratifying increase in Corporate Membership which had grown from 9 in 1944 to 29 with 22 students at the present time; he expressed the hope that it would continue, urging all present who were not Corporate Members to give the matter their serious attention, as he felt it was in their interest to support an Institute which catered for their particular industry, particularly as it was the only one of its kind in Britain. The Institute was doing very good work in the direction of furthering and fostering the professional status in the industry. The question of the new publication *I.P. Review* was discussed and it was agreed that Non-Corporate Members of the South Wales Branch should pay an annual composite subscription to cover the cost of the publication so long as it remained at its present cost to such members.

The revised Branch Rules were agreed to.

The Honorary Auditors were elected, these being C. E. Jones and E. J. Jones.

The whole Committee having resigned in order to facilitate the operating of the new rules, the following were declared elected to the Committee as the result of a ballot: R. P. Brownlee, P. F. Ellis, J. A. Green, E. J. Horley, T. F. Perry, R. B. Southall, E. S. Squire, D. W. Thomas, E. Thornton.

This Committee subsequently elected the following Officers: *Chairman*, R. B. Southall; *Deputy Chairman*, E. Thornton; *Hon. Secretary* and *Treasurer*, E. J. Horley.

BRITAIN AND THE OIL INDUSTRY*

By A. E. DUNSTAN (Past-President)

MUCH interest has been shown in recent years in the accessibility and the availability of the world's supplies of petroleum, and it will be the purpose of this paper to indicate the part played in the oil industry by British science, technology, and enterprise. Admittedly the United States of America is the greatest producer and the greatest consumer of mineral oil and the products therefrom, and naturally has taken the premier place in the vast developments that have occurred. Admittedly also the meiosis that is so much a part of the mental make-up of the British race has led to a characteristic self-depreciation of the great efforts Britons have made and are making in many parts of the world in this great industry, but as a matter of fact, it should be noted that the largest oil refinery in the world is sited at Abadan on the Persian Gulf and is owned and operated by a British company.

It will be convenient first to consider the distribution of known oil-bearing territories in many of which Britain has played a conspicuous part, but first it should be emphasized that the Empire, at the moment, merely produces something of the order of 3 per cent of the world's supply of mineral oil. (See Table I.)

When important talks were proceeding in Washington some two years ago —talks of the greatest importance to Britain and her survival as a consumer and producer of oil, the British public took but the faintest interest in them. Cotton, wool, steel and engineering are obviously of the highest value in our national synthesis. Oil is foreign—oil is political—oil occurs to only a small extent in our own islands, its importation in various finished refining states gives little direct employment apart from distribution. It is even regarded as an unpleasant competitor of our native coal. So long as the Navy and the Mercantile Marine get their fuel the world over, and in plenty, nothing else apparently matters, but it must be admitted that this view is intolerably short-sighted. The advantages of liquid fuels are so obvious that no insular prejudices can stand in their way.

Let us consider what is obtained from mineral oil—the essential high octane and other fuels that make possible the operation of our aircraft, our cars and all road and rail transport vehicles; the burning oil that illuminates our cottages, incubates our chicks and services our railway signals and our lighthouses; the lubricants that render possible the free running of all our machinery from the humble sewing machine to the

TABLE I

	Production		Estimated proved reserves at Dec. 31,
	1946	1945	1946†
	In 1000 metric tons		
United States	248,030	245,000	2,821,000
Venezuela	56,760	47,310	1,030,000
U.S.S.R. (incl. Sakhalin)	22,500	20,500	1,041,000
Iran	19,460	17,110	925,000
Saudi Arabia	8,200	2,900	676,000
Mexico	6,940	6,130	118,000
Iraq	4,700	4,600	666,500
Roumania	4,370	4,830	54,000
Colombia	3,180	3,200	71,000
Argentina	3,000	3,300	39,000
Trinidad	2,970	3,070	42,500
Peru	1,770	1,940	20,000
Egypt	1,280	1,340	19,500
Bahrein	1,100	1,000	37,500
Canada	980	1,090	20,000
Austria	850	450	11,000
Kuwait	800	—	1,216,000
Hungary	690	660	10,000
Germany	650	550	11,500
Ecuador	320	350	3,500
Neth. E. Indies	300	1,090	109,000
Brit. Borneo	300	300	11,000
India and Burma	290	360	15,000
Other Countries	860	750	152,000
Total	390,300	367,830	9,120,000

† Based on U.S. Bureau of Mines figures.

* Based upon a lecture delivered to the Northern Branch of the Institute.

heaviest rolling mill; the waxes that waterproof paper, insulate cables and constitute the common candle; the bitumens that give our modern road surfaces; and, just coming into view, the synthetic chemicals, insecticides, dyes, explosives, medicaments, plastics and rubber that will revolutionize our life in the near future. All these derive from petroleum.

These various objectives have long been realized in Germany and in the U.S.A., and the knowledge that crude oil is the foremost chemical raw material has become firmly established in those countries just as a century ago coal tar was similarly regarded in Great Britain as the basic starting out material for the then nascent synthetic chemical industry. The U.K. led in the development of synthetics derived from coal tar—it should not lag behind in the development of the synthetic petroleum industry. The days have long passed when the simple fractions obtained by distillation of crude oil were sufficient for the demands of our every-day life. More and more it has been discovered that petroleum is the source of simple entities ("bricks") from which a vast multiplicity of products may be derived just as, to quote an example, modern high duty aviation spirit is by no means a straight derivative of mineral oil—rather it is a complex built up from simple components—so similarly will be innumerable other derivatives from petroleum.

Pioneers in Refining

What part has been played in these developments by Britain? Nearly a hundred years ago that great pioneer, James Young, established in Scotland the shale-oil industry—still flourishing—an industry that anteceded that of petroleum. The methods developed by Young and his contemporaries (honoured names like Redwood, Bryson,

Courtesy News Chronicle

A piece of British-made equipment starts on its journey to Venezuela. This 108-ton column, 83 ft. 3 ins. high and 10 ft. 4 ins. diameter, had to make a long detour from Greenwich in order to reach the Royal Albert Dock for shipment.

Thomson, Beilby, Henderson, and Gray, come to mind) were of fundamental importance to this young industry and it is by no means without interest that so long ago as 1865 a patent was granted to Young for the "cracking" of heavier into lighter oil. Upon this outstanding development much of modern petroleum practice has been established. The student of mineral oil technology needs not to be reminded of Scottish oil experience in the distillation, treatment and refining of a wide range of products but the layman should note that present petroleum methods quite clearly originate from this work.

Other well known British men of science come into this picture—Faraday, Abel, Dewar, Bone, Wheeler, Tizard and Pye. All these men played a great part in laying the scientific foundations for the modern development of the technology of petroleum, although great credit is due to American technologists for the commercialization of so many discoveries. Only infrequently has British invention reaped the due reward of its efforts; it is scarcely necessary here to refer to Perkin's pioneering work on the coal tar dyestuffs which was followed by the catastrophic loss of a great industry into German hands. In so many instances the outstanding technical structure has been built elsewhere, but the foundations were well and truly laid in Great Britain.

For example in the technique of distillation early and promising original work was not exploited as it might have been. Even as long ago as 1883 Henderson introduced continuity of operation, the crude (shale) oil passing by gravity flow through a series of stills set in cascade fashion, and such refinements as heat economy through thermal interchange between hot vapour and cold crude were due to this Scottish technologist. A very comprehensive account of the methods in vogue up to the year 1915 was contributed by Campbell.* But in the years following the first world war the centre of gravity of development passed to the United States and the pipe-still came into big scale operation much in the same way as the water-tube boiler ousted the shell type. Here again tribute should be paid to Lennard who, at a much earlier date (1886), had installed a simple type of tubular heater in the works of the South Metropolitan Gas Company at Greenwich. But it must be admitted that the rapidly growing petroleum industry in America, and the recognition of the vast importance of sound technical training and the impact of such famous schools as the Massachusetts Institute of Technology on industry, enabled that country to seize hold of the opportunities that our own and others let slip.

Modern fractionating devices are an outcome of the procedure worked out in the early days of the nineteenth century for the separation of alcohol from the fermentation "wash". These methods were further developed for the separation of coal tar naphtha into benzol, toluol and the higher benzenoid homologues. All such processes were in operation in the United Kingdom in the pre-petroleum days, but were improved upon in modern American practice which achieved such a concentration of design that in one great unit so vast an amount as 5000 tons a day of crude oil can be split up into sharply diverse fractions such as petrol, kerosine, gas oil, lubricating oils and pitch. All this accumulated technique has been arrived at by research work in the universities and technical institutes, followed by its large-scale application in the refineries.

Mention has already been made of the pioneering work achieved in the refining of crude oils in Scotland. It is now desirable to develop this matter further.

The whole technique of the simple acid and soda treatments of oil distillates

* *J. Inst. Petrol. Tech.*, 1915, 2, 274.

was firmly established by James Young and his associates a hundred years ago and not very much has been done since then in this direction. Even in 1865 American oil refineries were refining their kerosine distillate with a dose of one per cent of sulphuric acid, and this rather rough and ready process still obtains. All kinds of improved methods were being developed in Britain. Perhaps the earliest (just rediscovered in America) was the superlative benefit of bauxite as a decolorizing agent for wax and for burning oil. A little later its use was extended to the desulphurization of every variety of distillate. Bauxite and its congeners have the further advantage of being admirable catalysts.

Still more important was the discovery in Britain of chemical methods of ridding petrol and burning oil of objectionable sulphur compounds. Such, for example, was the well known hypochlorite treatment. Apart from a multiplicity of more or less obvious chemical treatments developed in the U.K. and widely used elsewhere was the development of purely physical methods. Very early in the twentieth century was the outstanding discovery of the Roumanian chemist, Edeleanu, who showed that liquid sulphur dioxide was a preferential solvent for the deleterious components of burning oils. Edeleanu's work might have been completely lost sight of had it not been for the perspicacity of British oil companies who at once seized on the invention. Strange it is to relate that every modern method of refining crude lubricating oil derives from this discovery and there has arisen a multiplicity of solvents to achieve this simple purpose.

British chemistry and technology have been in the fore in the discovery that the simple hydrocarbons associated with crude oil and its products are of the utmost value in the newer syntheses that are now staring us in the face—the building up of plastics, artificial rubber and in fact all sorts of necessary commodities—dyes, drugs, fuels, medicaments, so essential to our modern way of life.

Credit must be given to these early pioneers who saw that these "petroleum bricks" would one day be concerned in the erection of great buildings.

Nor should those men be forgotten who by the hydrogenation of coal substance originated an even newer hydrocarbon science.

Coal and Oil

All the pioneering work on coal tar and its conversion into liquid fuel was carried out in the U.K. The mere fact that practically 50 million gallons per annum of benzole is now being produced is sufficient evidence that Britain has not lagged behind in this field. And during the war period a very considerable contribution to our liquid fuel resources has been made by the quite recent development of the use of a mixture of creosote and pitch—up to the remarkable figure of 600,000 tons a year, whilst a further 300,000 tons can be retrieved from pitch and its associated materials.

In the field of hydrogenation also our scientific and technical skill has been very fruitfully applied.

The high pressure technique first described by Ipatiev and later commercialized by Bergius has been successfully developed in Billingham and elsewhere in Britain, whilst, of course, in Germany synthetic fuel from the Fischer-Tropsch processes were of vital importance in the war period. It is more than likely however that such methods will be most profitably employed in regions where cheap natural gas is available.

Engine Fuels

At this stage it may be of interest to discuss briefly the fuelling of the so-called diesel engine—better named the

compression ignition engine. Great Britain has been in the forefront of its development specially for marine work and for road vehicles and to-day we see the bulk of omnibuses and lorries moved by the compression ignition engine. Not only in such *ad hoc* developments has British enterprise been of value but perhaps more importantly has it shone in the fundamental researches on the *modus operandi* of the engine itself. Ricardo, Tizard, Pye, and Egerton and their associates indicated many years ago the necessary conditions for the development of maximum efficiency in the internal combustion motor. Their work was of such vast importance that in effect, every motor-car on the road to-day owes its high performance to the work of these pioneers—which admittedly was followed up by the urgent need for appropriate fuels. In this respect again America took the lead although in the earlier days British benzole played no inconspicuous part.

Production Developments

In the necessarily brief survey of what British science has done for the oil industry it would be only fair to indicate other pioneering efforts—those for example in pipeline construction—in the welding and maintenance of line—in tank and storage installations—in ocean transport and tanker construction—in the bulk and retail distribution of products.

It is of some interest to note the impact of British exploration and enterprise in Asia and the Near East. British and Dutch companies have been actively engaged in the Asiatic field for many years. It is important to realize that active exploration has been and is proceeding in Egypt, Palestine, Syria, Arabia, Iraq, Iran, India, Burma, Borneo, Sarawak, New Guinea and Papua; and much of this has been under the aegis of the British flag.

British interest in oil production overseas is by no means concerned with these countries—it has important properties in Venezuela, the Dutch East Indies, Roumania, and even in the U.S.A., apart from its Empire interest in Trinidad, India and Burma, Borneo and Canada. These British investments in overseas oil production amounted, according to the Bank of England Statistical Summary for December 1938, to no less than £124,000,000 of nominal capital and provided an income of some £17,500,000 in 1937, only a portion of which derives from the sale of oil in the U.K. This overseas interest in oil also provided a most welcome addition to the country's export trade, for in 1947 the expenditure in the U.K. on stores and oilfield equipment was nearly £47 million, while at the end of 1947 over 60 per cent of the world tanker construction was being carried out in British yards.

Very brief mention may be accorded to geology and geophysics in so far as they refer to petroleum development. Even so far back as 1913 courses in mineral oil geology were provided at the Royal College of Science, South Kensington, whilst in 1912 a diploma in petroleum mining was awarded in the University of Birmingham. Full recognition should be given to the late Lord Cadman for this. In no way was Britain behind in its furtherance of research and instruction in these subjects.

The ever increasing urge for discovering and developing new sources of oil supplies led to surveys that have been conducted throughout the world in a thorough and systematic manner. Every variety of ancillary knowledge has been brought into play and especially detailed laboratory examination of oilfield problems; and furthermore practical methods of surveying well structure owe not a little to British efforts. To these efforts we owe the discovery of many new and promising fields, some even in

our own island. But much of the more recent technique of geophysics can be attributed to Britain and Europe. In the early days of the twentieth century the Étvos gravimetric (torsion balance) method laid the foundations for the discovery of underground structure and therefore in 1900 there was available for application in the search for oil an instrument eminently fitted for the purpose. The Étvos torsion balance was not widely known till 1920. Clearly, of course, it was necessary to correlate geology with geophysics and a little later other methods were brought into play, as for example seismic exploration depending on the refraction and reflection of waves starting out from the surface down to the oil-bearing strata. Such methods have been very widely applied, but it should be emphasized that Britain has played an important part in these developments. The then Anglo-Persian Oil Company introduced geophysical surveying into Persia in 1924. There was a time when the whole technique of drilling was a North American perquisite, but with the gradual invasion of the world's oilfields by British personnel the picture has changed. Twenty-five years ago the number of British drillers was negligible; oil was largely produced by foreign companies and therefore no opportunity arose for such indigenous specialized training. Britain although always largely and financially interested in oil matters relied entirely on outside help in production. But to-day British drilling and oilfield equipment is used in every field under British control. British trained drillers have taken the opportunity provided by British oil companies to make our nation quite independent of foreign personnel—and the result has been that the most difficult drilling problems attempted in any part of the world have been successfully solved by British engineers using equipment that is entirely of British design and manufacture.

EDUCATION

There remains perhaps the most important aspect of all and that is the education of the young petroleum technologist. Mention has been made of our great schools in Birmingham and London and other subsidiary training grounds elsewhere. Many years ago the late Sir William Ramsay said, "The country is too concerned with training privates—it should concern itself with the captains."

Here is a point that has possibly escaped us. Taking a line from the famous Massachusetts Institute of Technology and other similar colleges in the United States—can we really feel that in the U.K. we are training our best men in the best way? Corporals and not captains? Is it not vitally important that our great oil companies who in the last resort simply and completely depend on most adequate and well-trained technical staff should come together and think together, and endow research fellowships in our universities and technical schools—procreate men accustomed to think independently, follow the truth independently, build on the old foundations independently and in effect build up for the country a sound ethic of scientific technology. All this to the best of its ability is being done to-day by the only technical association in the world devoted only to petroleum science and technology—our Institute of Petroleum, a body of technical and scientific men founded and supported by a number of great leaders in the industry, notably the late Sir Boverton Redwood, the late Lord Greenway, and the late Lord Cadman.

These men clearly saw that no efforts put forward by Britain could be of avail without a strong effective community of scientific and technically trained men. Their work is to be seen to-day made effective in a great and flourishing society that has played and will play an ever increasing part in the furtherance of the petroleum industry.

E. A. Evans

THE COUNCIL AND OFFICERS OF THE INSTITUTE—1948-49

THE nomination of Mr E. A. Evans, M.I.Mech.E., F.R.I.C., as President of the Institute for the Session 1948-49, as announced in these columns in November last, was unanimously approved by the members at the Annual General Meeting on April 30.

VICE PRESIDENTS

At the same meeting the Council nominated six Vice-Presidents and these nominations were also approved without dissent.

The Vice-Presidents are:

E. B. Evans, Ph.D., M.Sc., F.R.I.C., who was first elected to the Council in 1939, is well-known to the readers of the *I.P. Review* as the Institute's Honorary Associate Editor and the Deputy Chairman of the Publications Committee.

Dr Evans was elected an Associate Member of the Institute in 1928, was transferred to Member in 1934 and to the Fellowship in 1939. Since his election to Council he has served on the Education, Election, Public Relations, Publications and Standardization Committees and at present is serving on all except the Election Committee. In the sphere of Standardization he is chairman of Sub-Committee No. 3 (Liquified Petroleum Gases, Gasoline, Kerosine and Light Distillates) and from 1944 has acted as secretary of the Hydrocarbon Research Group of the Research Committee.

E. B. Evans

In 1926 Dr Evans joined the Anglo-American Oil Co. Ltd. at the Purfleet installation and was subsequently at the Vauxhall laboratories and in the Technical Sales Department at headquarters. On the outbreak of the Second World War he was seconded to the Chemical Department of the Petroleum Board, rejoining "Anglo" in 1945. In 1946 he took up his present position as Research Co-ordinator in the Abingdon laboratories of the Esso Development Co. Ltd.

The Institute's *Journal* and other petroleum literature has been frequently enriched by contributions from the pen of Dr Evans. He has written on such subjects as viscosity and other properties of hydrocarbons, on sulphur in gasoline, on knock rating of hydrocarbons, on solvents, on kerosine, on motor gasolines, etc.

H. Hyams, whose name in the petroleum industry is synonymous with standardization of oil measurements. Two well-known and authoritative works on this important subject bear his name as author; they are "The Sampling and Measurement of Petroleum Cargoes" and "Oil Measurement Tables". Also Mr Hyams as Chairman of the Standardization

H. Hyams

Sub-committee on Oil Measurement and Sampling, has been the inspiration behind the Institute's publications "Measurement of Oil in Bulk, Part I—Standard Weights and Measures" (1932) and "Tables for Measurement of Oil" (1945).

Joining the Asiatic Petroleum Co. Ltd., in 1919 as assistant to Mr James Kewley (then chief chemist of the Company), Mr. Hyams has been attached to the London technical department and has been closely associated with the growth and development of the sales technical activities of the "Shell" group during the last 29 years. His activities have involved him in senior responsibilities relating to such matters as standardization, laboratory equipment, oil measurement and loss control, technical information, and library and office management. In this connexion he has frequently visited most European countries and in 1946 made an extensive tour of the U.S.A. and Venezuela.

As a Fellow of the Institute and a Member of Council since 1944 Mr Hyams has been an active participant in the work of several committees, such as, in addition to the Standardization Committee, the By-Laws Committee (of which he is chairman), the House, Public Relations, and Publications Committees. As a member of the latter he gave conspicuous service as chairman of the sub-committee which brought the *I.P. Review* into being and has recently been appointed to the chair of a new sub-committee which has the important function of considering "Circulation and Costs". In addition to his standardization activities already mentioned he is the deputy chairman of the Nomenclature Sub-Committee. He also represents the Institute on the Association of Special Libraries and Information Bureaux, of which he is a member of Council and of the Executive and Finance Committees.

Professor V. C. Illing, F.R.S., joined the Institute in 1916, was elected to the Council in 1930 and served as Vice-President for the period 1942–47. He was first associated with oil as a teacher in petroleum technology at the Royal School of Mines in 1913; later became a Professor of Oil Technology at the same College and has been primarily responsible for the building up of a school paying particular attention to the problems of oil geology. He has travelled widely and has devoted a considerable part of his life to the study of the oilfields of the Caribbean, particularly Trinidad and Venezuela. He first visited the former in 1913, and later began a series of yearly visits to Venezuela, firstly to the Maracaibo area and later to Eastern Venezuela. Here he was instrumental in the discovery of a group of oilfields in the western part of the State of Guarico where active exploration is now going on.

Professor Illing's travels in search of knowledge were normally made in vacation periods of the Royal School of Mines but war and the post-war demands for petroleum for Britain have in recent years necessitated much longer absences from England. In 1947 he successfully negotiated a settlement of the expropriated properties of the Aguila Co. with the representative of the Mexican Government.

V. C. Illing

In recent years Professor Illing's activities have expanded and he has found it necessary to form a company,

Petroleum Scientific Services Ltd., of which he is the managing director, which is primarily concerned with the solution of scientific problems associated with the search for and development of new oilfields. Visualizing also the need for an expanded use of geophysics in the search for oil, he took a leading part in the formation of Seismograph Service Ltd., the British affiliate of Seismograph Service Corporation of Tulsa, U.S.A. This British company has geophysical parties operating in various parts of the world, and whilst maintaining close connexion with its American parent is manufacturing its own geophysical equipment in England.

J. A. Oriel, C.B.E., M.C., M.A., B.Sc., who was elected a Member of Council in 1940 and has been a Vice-President since 1943, has been particularly associated in recent years with petroleum refining in Britain. Foremost in his activities in this direction was the plant erected by Heysham for the production of high octane number aviation fuel. Much of this plant was of his design and throughout the war he was closely connected with its management and operation. Apart from this major project he was responsible for much of the drive and energy behind the laying of the pipeline network which spread over Britain and it was due to his skilful supervision that other British refineries were able to be expanded in spite of the difficulties due to war.

J. A. Oriel

Leaving Cambridge in 1921 Mr Oriel joined the Anglo-Mexican Petroleum Co. Ltd., and for some time was in the Company's Central Laboratory. Subsequently he served at Shell Haven, as refinery manager in Suez, with the Bataafsche Petroleum Maatschappij at the Hague, and with the Chemical Department in London. In 1938 he was appointed General Manager of "Shell" Refining and Marketing Co. Ltd., and, when Mr Kewley retired two years later, he became also Chief Chemist of the Asiatic Petroleum Co. Ltd. (now Shell Petroleum Co. Ltd.) and of the Anglo-Saxon Petroleum Co. Ltd. Since that date he has combined the three positions, a tribute to his talents, experience and personality.

In the service of the Institute, Mr. Oriel has been especially active as chairman of the Branches Committee and has done much to foster the Institute spirit throughout the industry in all parts of the United Kingdom. He is also a member of the Committees concerned with the Benevolent Fund Finance, Public Relations, Research, and Standardization.

C. A. P. Southwell, M.C., B.Sc., is Managing Director of the Kuwait Oil Co. Ltd., and was formerly Manager of the Fields and Geological Branch of the Anglo-Iranian Oil Co. Ltd. Trained as a mining engineer, with early experience in coal and metal mining, he graduated in mining engineering and also in the School of Petroleum Technology of Birmingham University. His first post in oil was with Messrs S. Pearson & Sons Ltd., as an assistant to the late E. L. Ickes. Following this he went to Trinidad for the Colonial Office and became Petroleum Technologist to the Government of the Island.

C. A. P. Southwell

In his wide experience of oil exploration and development he has travelled extensively in the Far East, the Middle East, and the West.

Mr Southwell has served on several Government committees, including that set up by Mr E. Bevin (then Minister of Labour) to advise on the business training and education of ex-service men and women.

Joining the Institute in 1928, Mr Southwell was elected to the Council in 1936 and has served on various committees, being the present Chairman of the House Committee. He has contributed a number of papers to petroleum literature, his last being on "Petroleum in England" which he read before the Institute in 1944.

In his early days he was well-known in athletic circles, being captain of Birmingham University Rugby Team and also *Victor Ludorum* with hurdles, high jump, and mile as his events.

He was awarded the Military Cross in the First World War. In the Second World War, as soon as the Hannover basin oilfields were liberated, Lt.-Col. Southwell went to Germany as an adviser to the 21st Army Group on problems connected with safeguarding and rehabilitating the oilfields.

Hugh C. Tett, B.Sc., D.I.C., who has been Chairman of Council for the past session, has been a Member of Council for 11 years and was first elected a Vice-President in 1947. His association with the Institute dates from the time when he joined the petroleum industry as a laboratory assistant in the Technical Sales Department of the Anglo-American Oil Co. Ltd., in 1928. Two years later he became assistant manager and in 1935 manager of the Technical Department. In 1939 he transferred to the International Association (Petroleum Industry) Ltd., as assistant to Mr D. A. Shepard in the co-ordination of technical sales matters throughout Europe for the Jersey organization. In 1940 he was the senior technical representative of the organization in England. In this capacity he served on the Technical Advisory Committee of the Petroleum Board, on the Aviation Supply Committee, and on the Inter-Services Co-ordination of Specifications Committee. In 1941 and in 1943 he was a member of the missions of the Ministry of Aircraft Production which visited America in connexion with supplies of 100-octane fuel.

Hugh C. Tett

When the Esso Development Co. Ltd., was formed at the beginning of 1947 to take care of the Esso group's expansion of research and development activities in the U.K. and in Europe, Hugh Tett was appointed its managing director.

Prior to his election as Chairman of Council Mr Tett had served on several Council committees, including the Finance Committee and the Research Committee, being Chairman of the latter.

HONORARY TREASURER

G. H. Coxon (Anglo-Iranian Oil Co. Ltd.) was unanimously re-elected Honorary Treasurer.

HONORARY SECRETARY

C. Chilvers, B.Sc., F.R.I.C. (Manager Technical Sales Dept., Anglo-American Oil Co. Ltd., and Joint Manager, Chemical Dept., Petroleum Board), was unanimously re-elected as Honorary Secretary.

COUNCIL

The following, having been nominated by the Corporate Members to fill vacancies in the Council and a ballot not being necessary as the number of candidates equalled the number of vacancies, were declared to be elected as new Members of Council:

W. S. AULT, B.A., Chief Technical Adviser, Shell-Mex & B.P. Ltd.

C. T. BRUNNER, M.A., Assistant General Manager, Shell-Mex & B.P. Ltd.

T. F. LAURIE, General Sales Manager, Anglo-American Oil Co. Ltd., and Joint General Sales Manager, Petroleum Board.

H. E. F. PRACY, B.A., Joint General Manager, "Shell" Refining and Marketing Co. Ltd.'s refinery at Heysham.

D. L. SAMUEL, B.Sc., A.R.I.C., Technical Adviser on Lubricants, including Greases, S.T.A. Dept., Shell Petroleum Co. Ltd.

G. H. SMITH, Ph.D., Chief Chemist, Scottish Oils Ltd.

E. STOKOE.

E. J. STURGESS, B.Sc., Chief Engineer, Shell Petroleum Co. Ltd.

*G. H. THORNLEY, M.Sc., Manager of Department for Technical Information, C. C. Wakefield & Co. Ltd.

*E. THORNTON, B.Sc., Technical Advisory Staff, Anglo-Iranian Oil Co. Ltd., attached to National Oil Refineries Ltd.

A. T. WILFORD, B.Sc., A.R.I.C., Chief Chemist (Road Services), London Transport Executive.

*W. J. WILSON, F.R.I.C., Head of Research Dept., Burmah Oil Co., Ltd.

** Retiring Members of Council eligible for re-election.*

The existing Members of Council not requiring re-election on this occasion are:

M. A. L. BANKS, B.Sc., F.R.I.C., Member of Production Dept., Refining Division, Anglo-Iranian Oil Co. Ltd.

A. T. BEAZLEY, M.B.E., B.Sc., A.M.Inst.C.E., Director and General Manager, Lobitos Oilfields Ltd.

E. J. DUNSTAN, M.Sc., Director, Manchester Oil Refinery Ltd.

F. L. GARTON, M.A., B.Sc., in charge of Engine Fuels and Lubricants Section, S.T.A. Dept., Shell Petroleum Co. Ltd.

F. MORTON, Ph.D., F.R.I.C., Chief Chemist, Trinidad Leaseholds Ltd.

J. S. PARKER, M.A., B.Sc., Refinery Manager, Lobitos Oilfields Ltd.

A. BEEBY THOMPSON, O.B.S., Consulting Engineer, A. Beeby Thompson & Partners.

R. R. TWEED, President and Managing Director, British Controlled Oilfields Ltd., and Managing Director, Trinidad Petroleum Development Co. Ltd.

H. de WILDE, M.Sc., M.I.Mech.E., Advisory Engineer, Shell Petroleum Co. Ltd.

The following were elected as *ex-officio* Members of Council representing the Branches on the nomination of the Council:

V. BISKE, B.Sc., F.R.I.C., LL.B. (Hon. Secretary, Stanlow Branch).

C. D. BREWER (Chairman, Stanlow Branch).

W. ROBERT GUY, F.R.I.C. (Hon. Secretary, Scottish Branch).

MERVYN MASON (Hon. Secretary, Northern Branch).

T. W. RANSON (Deputy Chairman, Northern Branch).

R. B. SOUTHALL (Chairman, South Wales Branch).

SAFETY IN DISTILLATION PLANTS

Safety Circular No. 95 just issued by the Association of British Chemical Manufacturers recommends the precautions to be observed in the distillation of inflammable liquids. These precautions have been agreed between the A.B.C.M., the Association of Tar Distillers, the British Chemical Plant Manufacturers' Association, and the Institute of Petroleum on the one hand and the Chief Inspector of Factories on the other, to replace those issued in 1926.

SYNTHETIC DETERGENTS WITH SPECIAL REFERENCE TO THOSE DERIVED FROM PETROLEUM PRODUCTS

By Dr P. L. STEDEHOUDER, Dr P. W. O. WIJGA and H. F. DAMMERS

Introduction

Probably the oldest detergent known is potash, obtained from vegetable ashes, which was used by the Sumerians many centuries B.C. for the degreasing of wool and for toilet purposes.

Pliny (23–79) described soap ("sapo") as a discovery of the Gauls, who employed it to impart a reddish colour to their hair. It was used for the same purpose by the Greeks and Romans (imported as Mattic balls), and also as a medicine. It was not applied as a detergent until the second century A.D., and even then on a very limited scale. The Romans knew medical preparations containing alkalies, fats and various vegetable oils, but these "soaps" were not used by them for cleaning purposes. According to ancient writing the Assyrians used a mixture of castor oil and alkali as a head wash.

As early as the seventh century A.D. soap had become important enough to cause the establishment of soap-maker's guilds in Italy ("arti"), after which its application increased gradually, though it was not until the seventeenth century that the use of soap spread wider in Europe.

The Mechanism of Detergency

The detergent action of soap is a highly complex phenomenon, the nature of which has been studied by scientists for several decades, many hypotheses having been put forward and subsequently rejected. A brief outline of the most recent views on this question may be of interest, for which purpose an indication of the behaviour of a soap molecule at a surface is necessary.

As is well known, soaps are alkali salts of higher fatty acids. Taking an example sodium stearate $CH_3(CH_2)_{16}COONa$, it will be seen that the molecule consists of a hydrocarbon radical $C_{17}H_{35}$- and a sodium carboxylate group—COONa. These two parts have very different properties; whereas a hydrocarbon is water repellant (hydrophobic) and insoluble in water, the COONa group is highly hydrophilic and enables the entire soap molecule to be dissolved in water, especially when warm. This particular structure is most important, as molecules which possess it (these are termed surface active) will arrange themselves in a certain way (termed orientation) at an interface, which is the area of contact between air and a liquid, or between two immiscible liquids, or between air and a solid, etc. Thus at the air interface of a soap solution, the insoluble hydrocarbon parts of the molecules are, as it were, repelled by the liquid and driven from it, so that they arrange themselves parallel to each other, with the sodium carboxylate groups (heads) in the water and the greater part of the hydrophobic hydrocarbon chains (tails) in the air. A schematic representation of this is given in Fig. 1.

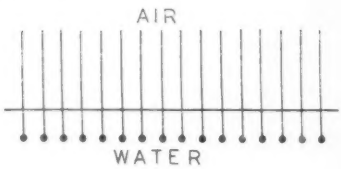


Fig. 1.

A similar arrangement takes place at oil/water and solid/water interfaces.

The soap molecules are adsorbed in oriented rows resulting in a boundary layer of some rigidity, because intermolecular forces are set up between the parallel hydrocarbon chains, of the same nature as the forces existing in a crystal lattice.

The ability of the soap molecules to orient themselves at an interface is responsible for a number of properties such as wetting, dispersion and emulsification, all of which properties are involved in the process of detergency. The mechanism of this process is now visualized as follows:

The soap solution, owing to its wetting power (i.e. ability to spread over a surface, even if oily), penetrates deeply into the material (e.g. fabric or skin). The above mentioned oriented adsorption causes the formation of protective films of soap molecules round the dirt particles at the same time causing these particles to break up into smaller ones. The latter are separated from the textile fibres by the enveloping film (the fibres being also protected by a coating), and kept in suspension. It will be obvious that the loosening of the dirt can be promoted by mechanical means, such as rubbing. Individual dirt particles, once they have been coated with soap molecules, are prevented from sticking to each other, or to the similarly coated fabric by the repulsion of the sodium carboxylate (-COONa) groups which are oriented outwardly. Hence the dirt particles remain dispersed in the soap solution and are rinsed away.

Development of Synthetic Detergents

Fatty acid soap suffers from serious defects when used in the many fields of application created by modern industrial development. Whatever the hydrocarbon chain of the various fatty acid soaps, all have a terminal alkali carboxylate group in common, and this is responsible for the low stability to hard water, containing calcium and magnesium salts. These salts react with the sodium or potassium fatty acid soap, forming a precipitate of calcium or magnesium soaps which reduces the amount of active material available for washing, etc., at the same time forming objectionable curds or scum which may be precipitated on the fabric, and considerably impair its appearance, handle and mechanical strength.

Fatty acid soaps are also unstable in acid solutions, this reducing their value in those textile and other applications involving such solutions. Most applications are, of course, based on alkaline solutions in which fatty acid soaps are stable.

The above defects of fatty acid soaps have led to the development of the so-called detergents which possess these defects to a minor or negligible extent only, as they produce lime soaps in hard water which are either soluble or readily dispersed. These synthetic detergents form a part of a large series of surface active agents which possess detergent, foaming, emulsifying, wetting and dispersing properties to a greater or lesser extent. Some are excellent in one or more of the above respects, but of limited value in others: none can be of the greatest value in all respects, since these functions call for slightly different characteristics in the type of molecule.

The product which may be regarded as the precursor of the modern synthetic surface active agents is Turkey red oil, which is obtained by sulphating castor oil (containing glyceryl ricinoleate). Since about 1860 it has been used in certain dyeing processes. After more insight had been gained into the relation between properties and molecular composition, the development of surface active agents has since about 1925 gradually assumed enormous proportions, so that at the moment there are on the American market no less than about 300 products of very different composition and properties.

The most important of the existing products may be classified as follows:

A. Products derived from fatty acids;
B. Sulphuric ester salts of higher alcohols;
C. Alkyl sulphonates;
D. Alkyl aryl sulphonates;
E. Cation-active agents;
F. Non-ionic surface active agents.

A—*Products derived from fatty acids*

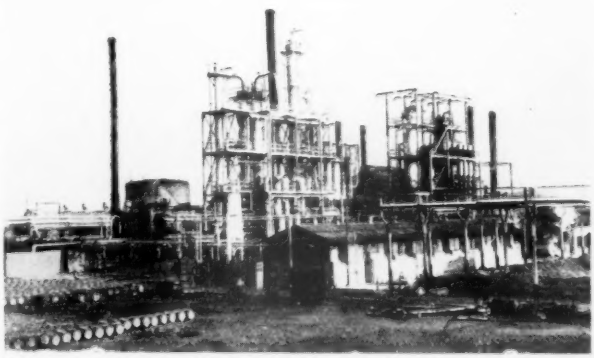
In the case of these products various methods have been used to counteract the unfavourable action of the carboxyl group of the fatty acid. One of the means to effect this is to "block" the action of the carboxyl group by converting it to an ester, this having little or no hydrophilic properties, and adding a sulphuric group at the double bond, followed by neutralization, thus producing a new strongly hydrophilic group (-O-SO_3Na) which does not have the disadvantages of the alkali carboxylate group (-COONa). An example of this is Prestabitöl*, which is particularly used as a wetting agent, its detergent activity being low.

Similarly the carboxyl group can be converted to an amide (-CONH_2) which confers a higher degree of resistance to alkali and acids than the ester group. Some of the Igepon range such as Igepon A and Igepon T are produced by this esterification or amidation, the latter product being of the amide type. They are excellent cleaning agents and possess good lime soap dispersing properties.

B — *Sulphuric ester salts of higher alcohols*

The first representatives of this class were the fatty alcohol sulphates. These compounds are prepared by esterification of higher primary alcohols with sulphuric acid to acid esters, followed by neutralization with alkali. The chains generally contain between 10 and 18 carbon atoms, with a terminal polar group -OSO_3Na. The base material for the hydrocarbon chain is nearly always a fatty acid fraction, which is converted into the alcohols by reduction. The most widely used type is the sodium lauryl sulphate, examples of which are Sulphonated Lorol (English), Gardinol W.A. (German and American) and Dreft (American). These products show a very good stability in hard water. The American 1948 production is estimated at 40 million lb.

Products which may be regarded as derived from secondary alcohols also belong to this class of compounds. They



The Ester Salts Plant at Stanlow Refinery. The hot oil heater supplying the redistillation and solvents recovery plant is on the left with the redistillation pumphouse in the foreground. The wax cracking unit is on the right.

* Further data on this agent and other products to be mentioned later are given in the Appendix.

are the Tergitols and Teepol. This latter product will be discussed more fully under Sodium Secondary Alkyl Sulphates.

C—*Alkyl sulphonates*

These are compounds with the structure $R\text{-}SO_3Na$: the hydrocarbon chain is bound direct to the sulphur atom, in contrast to the ester salts discussed under B, which contain an oxygen linkage between C and S atom. As a result, they are more resistant to strong acids than the ester salts. The detergencies of the two types of compounds are very much on the same level.

During the war huge quantities of alkyl sulphonates called "Mersolates" (about 130 million lb annually?) were manufactured in Germany. The method of preparation is described under Development of Synthetic Detergents. The present American production of a similar product (m.p.189°F) is about 10 million lb per annum, but in the near future a very considerable increase may be expected.

D—*Alkyl aryl sulphonates*

At the moment the production of these sulphonates constitutes nearly half of the total output of synthetic surface active agents. The principal product is an alkyl benzene sulphonate (Nacconol), the alkyl group of which has a chain containing 10 to 14 C atoms. This type of substances also includes the alkylated naphthalene sulphonates, of which Nekal BX is an example. Unlike alkylated benzene (or toluene) sulphonates, which are more particularly detergents, products such as Nekal BX are especially used as wetting agents. The total production in America of alkyl aryl sulphonates for 1948 is estimated at 180 million lb.

E—*Cation surface active agents*

Though the production of these substances constitutes only a small percentage of the total production of surface active agents, they are in many respects valuable auxiliaries. They differ from the previous category in that the hydrocarbon chain of the molecule in aqueous solutions forms part of the cation, the anion often being a halogen ion. Cation active compounds may be used for wool scouring in acid media, but of greater importance is their capacity to improve colour fastness. They are, moreover, often recommended for bottle and dish washing owing to their germicidal and bactericidal properties, which anion active substances do not possess in the same degree. Examples of such substances are: Cetyltrimethyl ammonium bromide (Lissolamine A) and cetylpyridinium bromide (Fixanal C).

F—*Non-ionic surface active agents*

This last group of surface active agents, which is becoming increasingly important, consists of substances the hydrophilic part of which is a group that does not dissociate in water. They do not therefore show the normal ionic reactions, in consequence of which they are perfectly stable in hard water and in concentrated salt solutions. Their water-solubility is caused by a chain of ether oxygen bonds, e.g. in polyethylene oxide condensation products, like Igepal and Lissapol N, or by a number of hydroxyl groups, e.g. in monoesters of polyvalent alcohols, such as Span. Various substances of these types are known for their great lime soap dispersing action and their levelling effect in dyeing. Other products are used on account of their great emulsifying power.

METHODS BY WHICH THE PRINCIPAL SYNTHETIC DETERGENTS FROM PETROLEUM ARE PREPARED

Bearing in mind that natural and synthetic detergents consist of a polar (hydrophilic) group and a hydrophobic hydrocarbon group, it is not surprising that more and more of the synthetic products are being derived from petroleum.

which usually provides a cheaper and more consistent source of hydrocarbon materials than the fatty materials previously employed.

The more important synthetic detergents based on petroleum are:

(*a*) Salts of synthetic fatty acids;

(*b*) Alkyl aryl sulphonates;

(*c*) Alkyl sulphonates;

(*d*) Sodium secondary alkyl sulphates.

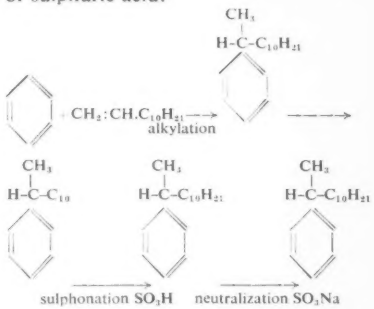
(*a*) *Salts of synthetic fatty acids*

Synthetic fatty acids may be obtained by the oxidation of paraffin wax with air in the presence of a catalyst, e.g. $KMnO_4$. As some cracking also takes place during this process, carboxylic acids are formed with a smaller number of carbon atoms than contained in the hydrocarbon which is oxidized, e.g. $2C_{18}H_{38} + 5O_2 \longrightarrow 2C_{15}H_{31}COOH + 2CH_3COOH + 2H_2O$. Neutralization of the higher molecular weight fatty acids with alkali gives soaps the composition and properties of which are comparable with those of the soaps made from natural fats.

During the war there were three synthetic fatty acid plants in operation in Germany, with a total intake capacity of 80,000 tons/year. Their yield of fatty acids suitable for soap manufacture was between 45 and 50 per cent. As feedstock they used paraffin wax of relatively low melting point derived either from the Fischer Tropsch plants or from the hydrogenation of brown coal. Although the synthetic fatty acid soaps thus prepared are properly speaking not based on petroleum, they are included since plant scale experiments in Germany showed that normal yields of reasonably satisfactory fatty acids suitable for soap manufacture could be obtained from petroleum slack wax. In Russia, too, industrial oxidation of petroleum hydrocarbons has been conducted on a limited scale, the products being used for both soaps and edible fats.

(*b*) *Alkyl aryl sulphonates*

These compounds may be obtained as follows: an aromatic hydrocarbon is made to react with an olefin, alcohol or alkyl chloride under such conditions that an alkylated aromatic is formed. This is exemplified by the reaction between benzene and dodecene, which may take place, for instance, under the influence of sulphuric acid:



Sulphonation of the resulting dodecyl benzene with the aid of strong sulphuric acid or oleum gives dodecyl benzene sulphonic acid, which is neutralized with caustic soda.

In actual practice use is made of a mixture of olefine obtained by cracking higher petroleum hydrocarbons. Similar products are also formed by starting from an alkyl chloride mixture derived from the chlorination of a fraction from kerosine. Complex mixtures of alkyl benzene sulphonates are therefore formed, the best known representatives of which are the American Nacconols.

(*c*) *Alkyl sulphonates*

Typical of these are the Mersolates made on a large scale in Germany during the war from a refined paraffinic Fischer Tropsch fraction containing on the average 15 carbon atoms per molecule, called Mepasin.

The method of manufacture is based on the following principle: the hydrocarbon is first sulphochlorinated, i.e.

treated under ultra violet light illumination with a mixture of about equal volumes of gaseous sulphur dioxide and chlorine, resulting in the formation of a sulphochloride mixture ("Mersol").

$$RH + SO_2 + Cl_2 \longrightarrow RSO_2Cl + HCl.$$

Thereupon the sulphochloride is saponified with caustic soda:

$$RSO_2Cl + 2NaOH \longrightarrow RSO_3Na + NaCl + H_2O.$$

This reaction gives rise to alkyl sulphonate ("Mersolate") and sodium chloride. According to German investigators suitable mineral oil fractions may also be used as feedstock, provided that they are refined to remove aromatics. At present alkyl sulphonates are made on a technical scale in America (M.P. 189° F). As is clear from the method of preparation stated above, the alkyl sulphonates, too, are very complex mixtures.

(d) Sodium secondary alkyl sulphates

These substances, also known as ester salts under the registered trade name of Teepol, have for some years been made on a commercial scale by the Shell Group (England), while the manufacture will be started on the Continent in 1948.

As base materials are used paraffin waxes either recovered from petroleum fractions direct, or obtained during the manufacture of lubricating oil. Cracking converts the paraffins into olefins; all the material which has a higher molecular weight than the C_{18} hydrocarbons is recycled, while the hydrocarbons lower than C_{10} are distilled off, to serve as feedstock for other chemical products. The C_{10}-C_{18} fraction forms the base material proper for the manufacture of ester salts. This material, which mainly consists of alpha-olefins, is reacted with concentrated sulphuric acid, resulting in addition of sulphuric acid to the olefins with formation of alkyl-sulphuric acid:

$$R\text{-}CH{=}CH_2 + H_2SO_4 \longrightarrow R\text{-}\underset{\displaystyle OSO_2OH}{\underset{|}{CH}}\text{-}CH_3$$

Side reactions are inevitable. Alkylsulphuric acid, for instance, may react anew with an olefin molecule with formation of dialkyl sulphate:

$$\begin{array}{l} CH_3 \\ | \\ CH\text{-}OSO_2OH \\ | \\ R \end{array} + \begin{array}{l} CH_2 \\ | \\ CH \\ | \\ R \end{array} \longrightarrow \begin{array}{l} CH_3 \quad\quad CH_3 \\ | \quad\quad\quad | \\ CH\text{-}O\text{-}SO_2\text{-}O\text{-}CH \\ | \quad\quad\quad | \\ R \quad\quad\quad R \end{array}$$

Further, olefins may polymerize in the presence of strong sulphuric acid. Under suitable conditions, formation of dialkyl sulphate and polymerization occur only to a minor extent.

The next manufacturing step consists in a treatment with caustic soda, which neutralizes the alkylsulphuric acid to sodium alkyl sulphate, the dialkyl sulphate being saponified, with formation of sodium alkyl sulphate besides higher alcohols:

$$\begin{array}{l} CH_3 \quad\quad CH_3 \\ | \quad\quad\quad | \\ CH\text{-}O\text{-}SO_2\text{-}O\text{-}CH \\ | \quad\quad\quad | \\ R \quad\quad\quad R \end{array} + NaOH \longrightarrow \begin{array}{l} CH_2 \quad\quad\quad CH_3 \\ | \quad\quad\quad\quad | \\ CH\text{-}O\text{-}SO_2ONa + CHOH \\ | \quad\quad\quad\quad | \\ R \quad\quad\quad\quad R \end{array}$$

The remaining phase of the process consists of the purification of the sodium alkyl sulphates obtained. This takes place mainly through extraction of the crude product with gasoline after addition of a suitable demulsifier. Concentration finally yields a solution containing a minimum of 21 per cent of active material and 6 per cent of sodium sulphate. Dry products can be made by spray-drying and by drum-drying. In the former case the product is obtained as a powder, in the latter case as flakes.

Similar secondary alkyl sulphates (Tergitols) are made in America from secondary alcohols, synthesized from aldehydes and ketones by condensation and subsequent reduction.

PROSPECTS

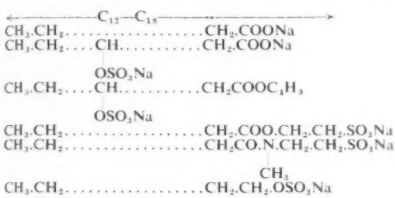
The consumption of surface active agents, which in America is estimated at about 10 per cent of that of fatty acid

soap, will increase considerably in the near future. This increase will probably not be due to a greater consumption by the textile industry, which at the moment uses about 50 per cent of the total production, but will be absorbed in the household and many applications outside the textile industry, such as laundry and dry cleaning, rubber (emulsion polymerization, pigment dispersion), fruit and vegetable washing, equipment cleaning, bottle washing, electroplating, leather processing, insecticides and fungicides, cosmetics, hard water soaps, and fire fighting.

This will probably cause the American production for 1950 to be twice that of 1946, viz, about 450 million lb.

APPENDIX

Detergents made from fatty acids (anion-active)

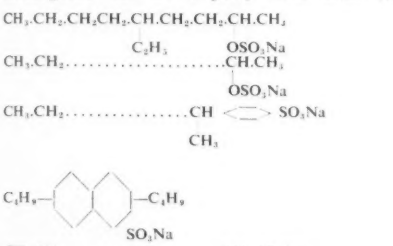


Fatty acid soap
Turkey Red Oil (since 1860)

Sulphated fatty acid ester
Prestabitol (Stockhausen & Co., since about 1925)
Igepon A (I. G. Farben, since 1930)
Igepon T (I. G. Farben, since 1931)

Fatty alcohol sulphates (since about 1931)
Gardinal (I. G. Farben)
Sulphonated Lorol (I.C.I.)
Duponol (Du Pont)
Dreft (Proctor & Gamble)

Detergents not on a fatty acid base (anion-active)

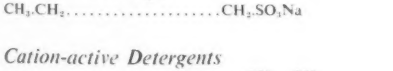


Tergitol (C.C.C.C.; since about 1938)

Teepol (Shell, since 1942)

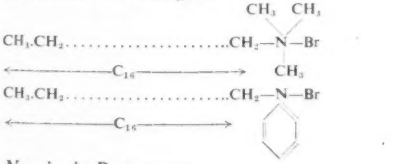
Alkaryl sulphonates

Nacconol (Nat. An. Chem. Co., since 1938)
Santomerse (Monsanto, since about 1938)
Nekal BC (I. G. Farben, since 1926)



Alkylsulphonates
Mersolat (I. G. Farben, since 1940)
M.P. 189 (Du Pont)

Cation-active Detergents

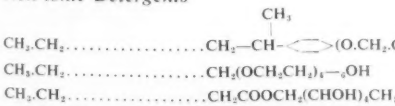


Cetyltrimethyl ammonium bromide

Lissolamine A (I.C.I.)

Cetylpyridinium bromide
Lissolamine V and Fixanol C (I.C.I.)

Non-ionic Detergents



Igepal W (I. G. Farben, since 1937)

Lissapol N (I.C.I.)

Span (Atlas Powder Co.)

THE RETIRING PRESIDENT ENTERTAINED

Following the Annual General Meeting on April 30, 1948, when Sir Andrew Agnew, C.B.E., retired from the Presidential chair, after occupying it since 1946, he was entertained to dinner by members of the Council.

The Chair at this pleasant function was taken by Mr Hugh C. Tett, Chairman of Council for the Session 1947–48, who proposing the toast of "Sir Andrew Agnew," said:

"I find myself to-night as Chairman of this dinner in a somewhat delicate position.

It is a rule of the Institute of Petroleum that, at all meetings where the President is present, he takes the Chair.

I would not, however, have you think that I find myself in deep waters through the Institute having, so to speak, swapped horses this afternoon.

The fact is that this is not a meeting of the Institute, it is a private and personal party arranged by the members of the 1947–48 Council in honour of our immediate Past-President, Sir Andrew Agnew.

The new members of the Council who were elected this afternoon are also with us, and we extend to them a very warm welcome.

We also have with us to-night two friends who, although they come from a great distance, we feel are so close to us that we should give ourselves the pleasure of their company.

We welcome Lee C. Burroughs and James G. Detwiler of the A.S.T.M. and A.P.I., who have done us a great honour by coming here to work with us on problems of mutual interest.

It is my very great privilege to-night to propose the health of Sir Andrew Agnew.

We have been fortunate indeed to have as our President the man who has led the oil industry of Britain for nearly 10 years, and who was personally responsible, far more than any other single person, for the remarkable wartime achievements of the industry, which he described to us so modestly this afternoon.

Much has been said and written about Sir Andrew, but his achievements, and the esteem and affection with which he is regarded by all his colleagues in the industry, are the true measure of his greatness, and are, I am sure, the tribute which he himself values most highly.

Many of us here to-night worked during the war in various capacities in and with that remarkable organization —the Petroleum Board.

Even in wartime the welding into a united team of diverse and intensely competitive commercial organizations —and personalities—could have been achieved only by a natural leader of men

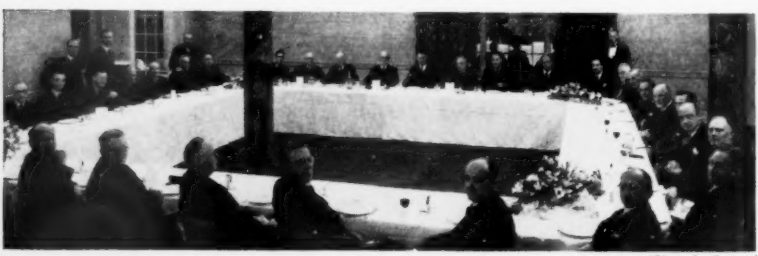


Photo by Rawood

"To-night I feel myself among friends"—Sir Andrew Agnew.

possessed of great wisdom and experience and who is respected and loved by all.

An American tourist in Scotland once came down a glen to find a village that seemed completely deserted.

After a while an old Scot came striding down the glen and was asked by the tourist: 'Say, Bud, where are all the people of this township?' The reply came: 'They're awa ruling the world.'

Sir Andrew has ruled a very large and important part of the oil world and we are proud that the Institute of Petroleum has been honoured by coming under his leadership.

When we asked him to become our President we knew that he was far too busy to attend all our meetings and functions.

He has, nevertheless, given his time to our affairs most generously and has fulfilled graciously, and with his natural dignity, all the calls we have made on him.

Mr Coxon and I, who have been privileged to serve under Sir Andrew as Chairmen of Council, have sought his advice on very many occasions.

His knowledge and experience and kindly wisdom have been invaluable to us during the past two years.

May I express to you, Sir Andrew, our very deep and sincere gratitude for the great service you have rendered the Institute as President.

The position you now occupy as Past-President entitles you to be a permanent member of this Council.

We hope that you will keep a warm place in your heart for the Institute and that you will sometimes in the years to come find time, as a past president, to join us in our more important functions."

Mr G. H. Coxon (Hon. Treasurer), seconding the toast, said:

"We on the Council are all very proud to have had Sir Andrew as our President during the past two years. I was particularly relieved when Sir Andrew intimated this afternoon that he would help us in our endeavours to obtain the support of the industry through our new Company-Membership.

To you, Sir Andrew, I say we shall miss you very much, particularly for your help which has always been so willingly given. The Institute has profited from your Presidency and I feel that the period now ending during which we have had a President and a Chairman of Council, has been a good one. We have been able to call upon you, as President, for advice in specific problems, leaving the day-to-day matters to be settled by the Council under its Chairman.

Thank you, Sir, for your help."

The Toast of "Sir Andrew Agnew" was enthusiastically received.

Sir Andrew Agnew: "I very much appreciate the great honour of having been President of the Institute for the past two years. When Mr Coxon, Mr Oriel and Mr Tett asked me to allow myself to be nominated for that position they assured me that there would be nothing to do. I have taken them at their word and have done nothing. On occasions I have met them and discussed some problem. But they have always had a solution to propose and their solution has always been the correct one. I thank them all very much for their help.

In your new president you have a very good man. He is an orator and will make a worthy and capable occupant of the presidential chair.

The Institute is developing on sound lines and the new members of Council who have been elected to-day should do much to assist in that development. In the past the Institute has probably been too technical. While the technical men are highly important in the industry, it must be remembered that there are two sides to the industry—technical and administrative. Both sides should get together for the good of the Institute.

Your Annual General Meeting this afternoon was an example of good organization and a mass of business was

completed in the short space of 25 minutes. But sometimes things go wrong as in the case of the three Scotsmen who went to Euston for the train to Glasgow. They were in good time and went to the buffet for a drink. Drink succeeded drink and when they did get to the departure platform the guard was giving the 'right away'. The three Scots rushed up to the train and a porter just managed to push two of them aboard. The third was left on the platform and, as the train disappeared out of the station, the porter turned to him and said: 'That's hard luck.' Said the Scot: 'It's a disaster —those two came to see me off.'

The greatest thing in life is friendship. To-night I feel myself among friends and hope that you all feel the same friendship for me as I feel for you. I see among you many who worked with me on the Petroleum Board. We spent many anxious days and nights planning and wondering and it was that same feeling of friendship that made the Board the success it was.

I am proud of being in the petroleum industry. Men versed in petroleum affairs have a far wider knowledge of the things with which the world is concerned than any other body of men. When they are gathered round the table they will represent the whole world.

In conclusion, let me say that I am proud to be your guest to-night, proud of all the kind things you have said, and proud to have been your President. I wish you every success."

A MESSAGE FROM THE A.P.I.

At the Annual General Meeting of the Institute of Petroleum on April 30 the following message from the American Petroleum Institute was received:

To the Officers and Members of the Institute of Petroleum.

The American Petroleum Institute tenders to the Institute of Petroleum greetings and felicitations through its representatives Mr L. C. Burroughs and Mr James G. Detwiler.

The American Petroleum Institute is fully conscious of the brilliant work of the Institute of Petroleum and offers congratulations on the very worthy accomplishments in the field in which we are both interested.

Cordially, W. R. Boyd, Jr., President.

On the proposal of the President the following reply was agreed for transmission to the A.P.I.:

W. R. Boyd, Jr., President, American Petroleum Institute.

The Institute of Petroleum expresses its deep appreciation of the greetings and felicitations of the American Petroleum Institute. We are no less conscious of the great achievements of our American counterpart and hope for the constant growth of friendly relations and successful co-operation between the two organizations.

Your message was read to-day at a general meeting of the Institute of Petroleum at which your representatives were welcomed. The members and officers of the Institute very cordially reciprocate your good wishes.

Andrew Agnew, President.

Petroleum Technology, 1941-5. Collects, collates, and reviews references to over 3000 technical articles. Published by the Institute of Petroleum. £1 1s. post free.

Mr A. Friedmann of the Polish Embassy asks us to point out that he did not write the article on the Polish petroleum industry (p. 120). He sent it out as head of the Information Department.

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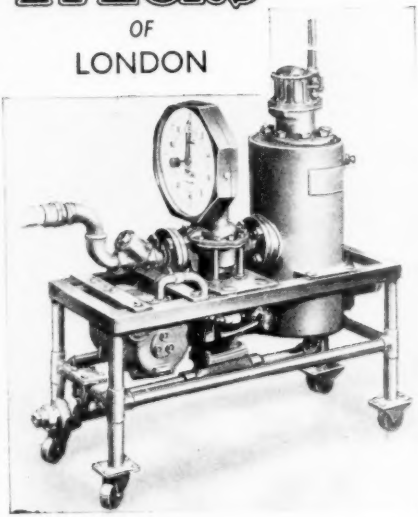
OF
LONDON



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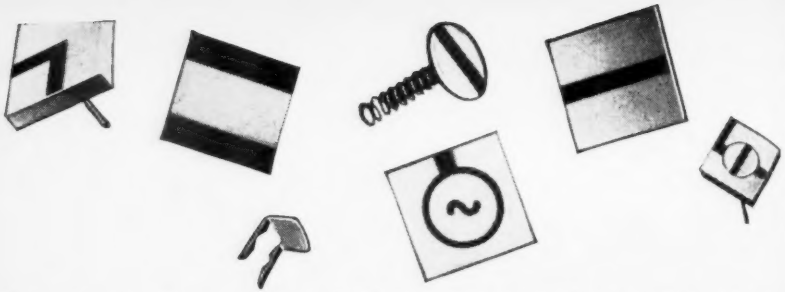
SITUATIONS VACANT

ANGLO-IRANIAN Oil Company require a **Mechanical Engineer** for work at their London Headquarters, with occasional visits overseas. Age 30 35. Degree or A.M.I.Mech.E. desirable. Applicants should have had experience in the preparation of specifications, selection of plant and its layout, for steam raising equipment; including combustion and feed water treatment, together with operating experience with large-scale boiler plant. Salary according to qualifications and experience. Reply, giving full particulars, quoting Dept. H.433 to Box 5197 at 191, Gresham House, E.C.2.

ANGLO-IRANIAN Oil Company require a **Mechanical Engineer** for work at their London Headquarters, with occasional visits overseas. Degree or A.M.I.Mech.E. desirable. Age 30 35. Applicants should have had experience in selection of plant and its layout together with preparation of specifications for internal combustion engine driven generating sets and pumping sets. Salary according to qualifications and experience. Reply giving full particulars quoting Dept. H.432 to Box 5208 at 191, Gresham House, E.C.2.

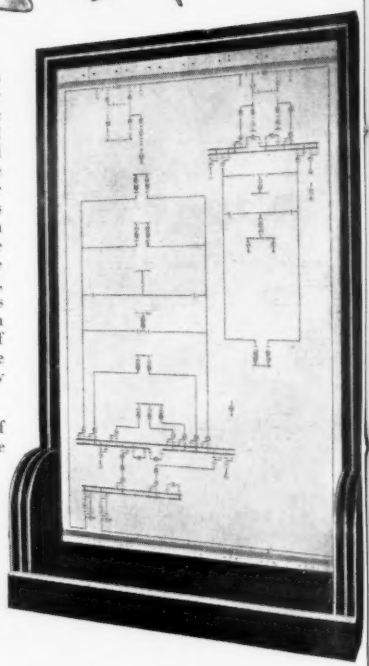
ANGLO-IRANIAN Oil Company require a **Mechanical Engineer** for work at their London Headquarters with visits overseas. Age 30 40. Graduate, A.M.I.Mech.E. or equivalent, and have served an engineering apprenticeship; experience needed in the manufacture of large oil engines and or centrifugal pumps. Applicants must also be able to prepare plant specifications, compare tenders, process arrangements and work. Reply, giving age, qualifications and experience, quoting Department, H.705 to Box 5236 at 191, Gresham House, E.C.2.



Remote Control of Electrical Installations

A complete pictorial record of electrical connections throughout an area can be built up and periodically adjusted to show any changes by means of the mosaic diagrams used with Supervisory Remote Indication and Control Equipment. These diagrams consist of small square pieces of plastic material with electrical line connections or apparatus symbols depicted on their surface. They are mounted on pierced mounting strips by means of simple clips and any required representation of electrical connections can thus be built up to suit the circumstances. Where necessary the circular centre portion of the moulded squares can be rotated so that, for example, the state of connections of circuit breakers and isolators can be shown. Should changes occur such as the addition of new stations or the re-arrangement of feeders, the appropriate section of the diagram can be revised quickly and conveniently to suit the new conditions.

These ingenious wall diagrams are but one example of the many ways in which A.T.M. Supervisory Remote Indication and Control Equipment can be applied to the needs of industrial, commercial or public utility establishments.



Supervisory Remote Indication and Control Equipment

A4131-C3

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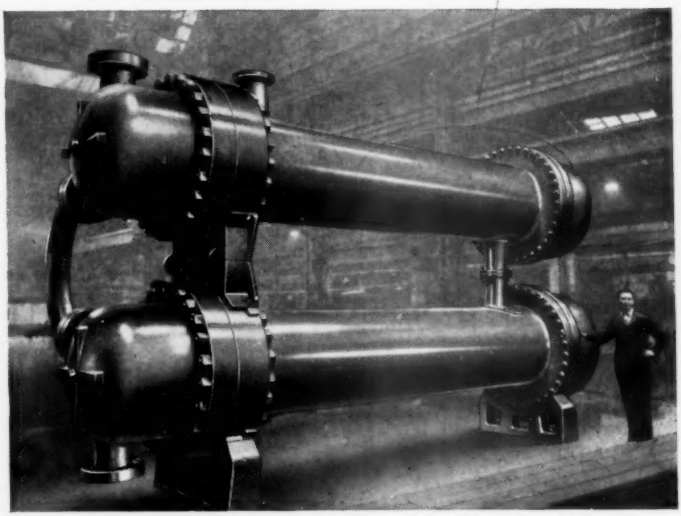
HEAT EXCHANGE EQUIPMENT



HIGH PRESSURE HEAT EXCHANGERS

Surface per Unit	... ...	2170 sq. feet
Working Pressure in Tubes	...	1500 lb. per sq. inch

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